

CASTANEA

The Journal
of the
Southern Appalachian Botanical Club

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PUBLISHED FOR THE CLUB
MARCH, JUNE, SEPTEMBER, DECEMBER
at
West Virginia University
Morgantown, W. Va.

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All persons interested in the botany of the Southern Appalachian Mountains are invited to join the club. Dues, including subscription to the Journal, are \$3.00 per year. Single copies of *Castanea*, seventy-five cents.

Notes and short scientific papers relating to the botany of the region are welcomed and will be published to the extent that the size of the Journal allows.

Authors will receive six gratuitous copies of the issue in which their papers appear. Separate reprints, if ordered in advance, will be furnished at cost.

CASTANEA

The Journal of the Southern Appalachian Botanical Club

Vol. 15

December, 1950

No. 4

Preliminary Reports on the Flora of Georgia—4. Notes on the Distribution of Flowering Plants Including Species New to the State.

WILBUR H. DUNCAN

In 1948 I reported the distribution in Georgia of Spermatophytes new to or rare in the state (Duncan, 1948). These data were obtained from vegetative surveys which were directed toward my ultimate preparation of a "Flora of Georgia." The vegetative surveys were continued more intensively during the two succeeding years and some older collections were named, with much additional data being obtained. These data include species new to the state, southernmost or northernmost records for certain species, and other significant and interesting information. In some instances accumulated data for various species were published; e.g.; Duncan (1950a, 1950b, 1950c, 1950d). Data for a large number of species are not included in these publications, however, and will be presented here.

In addition to material in the University of Georgia Herbarium (Ga), all Georgia collections in six large eastern herbaria were examined for most of the species listed in this paper. The herbaria were Herbarium of the Arnold Arboretum (Ah), Gray Herbarium (H), National Arboretum Herbarium (Na), Herbarium of the Academy of Natural Sciences of Philadelphia (Ph), United States National Herbarium (U), and Herbarium of the New York Botanical Garden (Y). A few specimens were also examined at the herbarium of the New York State Museum (Ym). Unless otherwise indicated, no Georgia specimens of any species included in this paper were found in these herbaria.

Data to follow are presented by species which are arranged alphabetically within genera, the genera being in sequence according to generic numbers taken from De Dalla Torre and Harms, "Genera Siphonogamarum." When no number is available for the genus, it

is placed under the number of a related genus, and indicated by suffixing an "A" (e.g., 9178A). Counties from which collections are cited are in small capitals (e.g., FULTON). The county name is usually followed in order by: (1) the collectors name (in italics) and collection number, if available; (2) the symbol for the herbarium in which the collection is deposited; (3) the date of collection; (4) the elevation above sea level given in feet ('); and (5) supplementary notes. A discussion follows the tabulation of these data for each species.

Vegetative surveys during 1948 and 1949 were made possible in part through grants-in-aid allocated by a research committee at the University of Georgia, from funds made available jointly by the Carnegie Foundation and the University of Georgia. Visits to the six eastern herbaria were made possible by funds allocated by Dr. George H. Boyd, Dean of the Graduate School, University of Georgia. Dr. Boyd also approved research funds for certain necessary supplies and equipment. Identification of some collections and checking of others were done by various persons. Some data were made available by Haskell Venard and G. W. McDowell of Atlanta, Georgia, and Robert Thorne of Iowa City, Iowa. This aid is gratefully acknowledged. The author, however, assumes full responsibility for the entire manuscript.

113. *MICROSTEGIUM VIMINEUM* (Trin.) A. Camus. EARLY: *Thorne* 7280 (Cornell University Herbarium); near Gilbert's Landing. FULTON: *Venard* 666 (Ga); 27 Sept., 1947; in ravine of Collier's Woods east of Northside Drive, Atlanta. SEMINOLE: *Thorne* 7195 (Ga); 10 Oct., 1947; bank of Chattahoochee River at Butler Landing.

This species is not included in Small (1933) and is reported by Hitchcock (1935) only from Virginia, North Carolina, and Tennessee. R. M. Harper [No. 3275 (H), 7 Oct., 1943] collected it northeast of Sheffield, Alabama. The above collections are the first reported for Georgia and the Seminole County collection is the southernmost for the species.

161. *PASPALUM FLORIDANUM* Michx. CLARKE: *L. Burke* 2 (Ga); 30 Aug., 1948; railroad bank in southern part of Athens. FLOYD: *F. W. Pennell* 4106 (Y); 5 Aug., 1912; Horseleg Mt. GWINNETT: *J. K. Small* (Y); 9 Sept., 1894; Yellow River near McGuire's Mill.

Hitchcock (1935) gives the range as "in the Coastal Plain" but these collections show that this species also occurs in the Piedmont Province. Small (1933) does add "and rarely adj. provinces," but with no indication of its actual occurrence in the Piedmont of Georgia.

166. *PANICUM RAMOSUM* (L) Stapf. CLARKE: *L. Burke* 4 (Ga); 29 Aug., 1948; (Det.: J. R. Swallen); waste area at edge of University campus.

This is an introduced grass and has not been reported previously as naturalized in Georgia, Hitchcock (1935) reporting it only from Mobile, Alabama.

242. *AGROSTIS PALUSTRIS* Huds. RABUN: *Duncan* 2628 (Ga); 30 June 1940; 3,400'; better drained soil edge of swamp north of Rabun Bald.

Although frequently introduced, its occurrence in the swamp was a surprise, as Maryland is the nearest previously reported state for this species (Hitchcock, 1935) and the swamp, although grazed a little by cattle, is rather isolated.

367. *BRIZA MINOR* L. CLARKE: *Pyron and McVaugh* 1794 (Ga); 18 May, 1937. *Cronquist* 4376 (Ga); thin soil on granite at edge of University of Georgia campus. COLUMBIA: *Duncan* 9501 (Ga); 260'; edge of woods ten miles southeast of Lincolnton.

This is an introduced grass previously unreported for Georgia although Hitchcock (1935) reports it for states immediately to the east, west, and south.

378. *POA SYLVESTRIS* A. Gray. CHEROKEE: *Duncan* 8223 (Ga); 2 May, 1948; rich terrace in deciduous woods along Jug Creek 2½ miles north of Canton.

This record makes a continuous distribution by states throughout the southeast, Georgia being the only state in the area for which Hitchcock (1935) does not report the species.

389. *BROMUS TECTORUM* L. BARTOW: *Duncan* 8155 (Ga); 24 Apr., 1948; railroad embankment in Allatoona.

This colony was apparently introduced via the railroad from areas to the north. The species was previously unreported for the state by Hitchcock (1935) or Small (1933).

525. *CAREX AESTIVALIFORMIS* Mack. RABUN: *Duncan* 7486 (Ga); 31 June, 1946; on north side of Rabun Bald.

Even with Mackenzie's (1940) excellent "North America Cariceae" being available I found my collections of *Carex* difficult to name with confidence. I, therefore, enlisted the aid of S. J. Smith of the New York State Museum, who either named or checked all species reported here. The present species is not reported by Small (1933) from the Southern States and Mackenzie (1940) reports it only as far south as "Delaware to Michigan." A part of Rabun Bald is one of

the few places in Georgia that simulates a more northern climate to the extent that plants of decidedly more northern affinities might persist there.

525. *CAREX ABDITA* Bickn. (*C. umbellata*, sensu Mackenzie). RABUN: Duncan 9338 and 9340 with S. J. Smith (Ga); 17 Apr., 1949; 3,100'; on steep rock exposure southeast of Glade Mountain.

This species is not reported south of the District of Columbia (Mackenzie, 1940). The present station is, therefore, quite an extension in range.

525. *CAREX AESTIVALIS* Curtis. TOWNS: Duncan 6933 (Ga); 4 Aug., 1946; 3,400'; rich cove on south slopes of Hightower Bald.

This species is reported from Georgia by Mackenzie (1940), although he had not seen it from the state. This collection definitely establishes the species as occurring in Georgia.

525. *CAREX AUSTRAL-CAROLINIANA* Bailey. TOWNS: Duncan 7601 (Ga); 28 May, 1947; 4,200'; dense woods of north-facing ravine just north of the summit of Hightower Bald.

This rare sedge had previously been reported only from North Carolina, Tennessee, and South Carolina. The present station is unlike any other locality I have seen in Georgia. It is likely, therefore, that few, if any, other stations for this species will be found in Georgia.

525. *CAREX BILTMOREANA* Mack. TOWNS: Duncan 8239 (Ga, Ym); 23 May, 1948; 4,100'; crevice of cliff at base of narrow ledge on south side of Hightower Bald.

This is the first record for the state, Mackenzie (1940) reporting this species only from the "Mountains of North Carolina," and Small (1933) giving "rocky soil, Blue Ridge, N. C." Specimens from North Carolina were the only ones seen in the herbaria visited. This species probably will be found on other high mountains in Georgia by more extensive collecting from such localities.

525. *CAREX BUSHII* Mack. ELBERT: Duncan 9419 (Ga); 25 Apr., 1949; 400'; small depressions of old logging road on open, pine-oak woods in rock soil (Iredell Series) on top of hill near junction of Broad and Savannah Rivers.

The material of this collection was young, but there is little doubt that it is of this species. Mackenzie (1940) reports it as extending "southward to the District of Columbia, Mississippi, and Texas." S. J. Smith tells me that he collected the species in Alabama. This is, therefore, the southeasternmost station known for the species and the first for Georgia.

525. *CAREX CONVOLUTA* Mack. BARTOW: *Duncan* 8306 (Ga, Ym); 13 June, 1949; 760; wooded hillside in rich soil on west side of Allatoona Creek about 1 mile south of Allatoona Dam. LINCOLN: *Duncan* 9823 (Ga); 20 June, 1949; deciduous woods on steep slopes on southwest side of Savannah River just opposite lower end of Price's Island.

Neither Mackenzie (1940) nor Small (1933) indicate that the species extends to the southeast as far as Georgia. Alabama and Tennessee are the nearest states that they give for the range of the species. A specimen from Sumter County, Georgia [R. M. Harper 1116 (U); 25 July, 1901; rich woods near Cherokee Creek] may extend the distribution of this species even farther to the southeast. I was unable to check accurately the determination and cannot with certainty, therefore, extend the range to Sumter County.

525. *CAREX CREBRIFLORA* Wieg. STEPHENS: *Duncan* 6454 (Ga); June, 1946; 775'; rock crevices of moist, shady cliff overlooking Tugaloo River northeast of Toccoa.

Mackenzie (1940) gives the ranges of this species as "Texas to Florida, northward to South Carolina." Georgia, therefore, is indicated as being in the range, but the present station from northeast Georgia would seem to be a considerable extension northward as well as a definite record for Georgia.

525. *CAREX GRACILESCENS* Steud. PUTNAM: *Duncan* 7904 (Ga, Ym); 11 Apr., 1948; wooded bottomland along Gladly Creek 5½ miles northwest of Eatonton in an area called the "Glades" (Det. by H. D. House).

This becomes the southernmost known collection for this species, Mackenzie (1940) and Small (1933) both indicating that it occurs only as far south as Tennessee and Arkansas. A collection of Chapman's in the Gray Herbarium from Florida labeled *C. gracilescens* does not appear to be of this species.

525. *CAREX LAXICULMIS* Schw. BARTOW: *Duncan* 8024 (Ga, Ym); 17 Apr., 1948; on rocks in rich wooded ravine southwest of the Etowah River, 6 miles east of Cartersville (Det. by H. D. House).

Neither Mackenzie (1940) nor Small (1933) reports this species as far south as Georgia. A collection by R. M. Harper [No. 3787 (Y, H, U) from Marion County, Alabama; 27 Apr., 1940; sandstone ledges on bluffs of Buttahatchie River about a mile northeast of Hamilton] and the Georgia collection are approximately same latitude. These collections extend the range of the species considerably southward.

525. *CAREX LAXIFLORA* Lam. WHITE: Duncan 9269 with S. J. Smith (Ga); 14 Apr., 1949; 2,000'; wooded ravine along Anders Creek 1.7 miles south of Unicoi Gap. RABUN: Duncan 9343, with S. J. Smith (Ga); 17 Apr., 1949; 2,600'; moist soil on narrow rock shelves of open ravine between junction of Pine Mountain, Burrell Ford, and Glade Mountain roads.

This species is new to the State, Mackenzie (1940) reporting it as occurring "southward to North Carolina and Kentucky."

525. *CAREX PURPURIFERA* Mack. RABUN: Duncan 9560 (Ga); 15 May, 1950; 2,600'; wooded mountain slopes near intersection of Glade Mountain, Pine Mountain, and Burrell Ford roads.

This collection is of considerable interest as this is one of the rare species of *Carex*. The species is reported by Mackenzie (1940) only from Campbell and Cooke Counties, Tennessee. Georgia is, therefore, the second state from which the species has been collected.

525. *CAREX TONSA* (FERN.) Bicknell. DE KALB: R. F. Thorne, W. C. Muenscher, S. J. Smith 7658 (Ga); 19 Apr., 1947; open woods near base of Stone Mountain. RABUN: Duncan 9307, with S. J. Smith (Ga); 16 Apr., 1949; 2,600'; slopes at Glades Falls southwest of Glade Mountain. Duncan 9330, 9332, 9333 with S. J. Smith (Ga); 17 Apr., 1950; 3,300'; on rocks on Glade Mountain.

Dr. Thorne called my attention to his collection being new to Georgia. Mackenzie (1940) indicates that the species extends "southward to District of Columbia, Indiana and Wisconsin." Virginia stations are the nearest which are represented by specimens seen in the herbaria which I visited.

826. *XYRIS AMBIGUA* Beyr. DOUGLAS: Duncan 8439 (Ga); 26 June, 1948; boggy area in and surrounding seepage at head of small stream 1.5 miles east of Villa Rica.

This species previously has been reported only from the Coastal Plain (Small, 1933). The bog in which this was found contains an abundance of plants characteristic of the Coastal Plain.

890. *TILLANDSIA USNEOIDES* L. COLUMBIA: Duncan 9792 (Ga); 28 June, 1949; 210'; south side of Little River about 1/2 mile above the Savannah River. MERIWETHER: Duncan 10750, with Donald Huttleston and H. Martin (Ga); 630'; in trees on west banks of Flint River 14 miles northeast of Manchester in Singer's Hill-Fuller Hollow region. RICHMOND: Olney and Metcalf 98 (U); Augusta.

Small (1933) gives "Coastal Plain and rarely adj. provinces" for the distribution of this species. L. B. Smith (1935), however, cites no specimens for the Piedmont of Georgia, the collection from Rich-

mond County being the most northern he gives for Georgia. The range is extended, therefore, considerably to the north and into the Piedmont. The Meriweather station at 630' above sea level may represent an elevation record for the species in the Southeastern United States.

959. *MELANTHIUM HYBRIDUM* Walt. (*M. latifolium* Desv.). RABUN: *Pyron and McVaugh* 865 (Ga); 25 July, 1936; dry woods 2 miles north of Clayton. COBB: *Duncan* 3889 (Ga); 12 Aug., 1941; near bottom of wooded ravine at Camp Bert Adams, north of Atlanta.

Fernald and Schubert (1948) point out the correct name for this plant, that it is known in the south from both North and South Carolina, and that Elliott gave a detailed description of a specimen received from Georgia. Small (1933), Britton and Brown (1913), and others omit Georgia from the range. The present records definitely establish this plant as a member of the flora of Georgia, the Cobb County station being the southwesternmost for the species.

1252. *DIOSCOREA BATATAS* Decne. CHEROKEE: *Duncan* 9017 (Ga); 835' 26 Sept., 1948; wooded terrace on east side of Little River 1 1/4 miles south of Etowah River. CLARKE: *Perry* 827 (H); 18 June, 1934; cemetery grounds, Athens.

Small (1933) does not include this species in his "Manual." The Cherokee County record leaves no doubt that this species has become firmly established in the wild in Georgia. There might have been some doubt on the basis of the occurrence in the cemetery in Athens. The species should now be added to the list of plants now growing in Georgia.

1548. *CORALLORHIZA MACULATA* Raf. TOWNS: 6977 (Ga); 3,600'; 25 Aug., 1946; at White Oak Gap southwest of Hightower Bald.

Small (1933) gives the range of this species as "woods, various provinces, rarely Coastal Plain, Florida to Texas, California, B.C., Ont., and Newf." Correll (1940), however, who has studied carefully the Orchidaceae of the Southeastern United States, placed the southern limits in North Carolina and Tennessee. The Towns County record, therefore, is apparently the first for Georgia and is the southernmost for the species.

1882. *CARYA LACINIOSA* (Michx. f.) Loud. GORDON: *Duncan* 8947 (Ga); 24 Sept., 1948; 2 miles south of Calhoun. *Duncan* 8953 (Ga); 2.8 miles east of Resaca. WHITEFIELD: *Duncan* 8962 (Ga); 6.4 miles south of Dalton. CATOOSA: *Duncan* 8963 (Ga); 1 3/4 miles west of Tunnel Hill.

The above stations are the first positive records for the state of Georgia. The species had been reported by Bishop and Duncan (1940) for Oglethorpe County, Georgia, on the basis of a determination made on vegetative material. I am now convinced that the determination was in error and that the earlier material is *C. ovata* (Mill.) K. Koch. Harrar and Harrar (1946) report *C. laciniosa* as far south as Florida but I am unaware of specimens to authenticate this contention. On the basis of my extensive field work in Georgia and a survey of existing herbarium material, I do not believe that *C. laciniosa* occurs beyond the region indicated by the collections reported here.

2656. *SCHISANDRA GLABRA* (Brickell) Rehder. (*Schizandra cocinea* Michx.). BARTOW: W. S. Grant, (U); 1874; Steagalls Station (now Emerson). FULTON: J. H. Pyron (Ga); 9 June, 1946; low, rich woods 11 miles southwest of Atlanta. MORGAN: Duncan 7743 (Ga); 25 July, 1947; wooded ravine near Hard Labor Creek in western part of County.

This vine is apparently very scattered and rare in its occurrence. Smith (1947), in his revision of the genus reported only one Georgia collection, from Steagalls Station by W. S. Grant in 1874. I made a considerable search in the University of Georgia library and found in the State Gazetteer for 1879-80 that Steagalls Station was a postoffice 44 miles from Atlanta on the W. and A. R. R. In 1889 Steagalls Station was incorporated with the name Emerson which is in Bartow County. This collection, therefore, and those from Fulton, Dekalb, and Morgan counties definitely establish the species as growing in the Piedmont. This seems to be a significant extension in range as Smith (1947) gives the distribution as "Southeastern U. S., Coastal Plain and Mississippi embayment,——."

3195. *HEUCHERA PARVIFLORA* Bartl. var. *RUGELII* (Schuttle, apud Kunze) Rosendahl and Butters. CHEROKEE: Duncan 8599 (Ga); 880'; 31 July, 1948; in crevices near base of cliff on south side of Shoal Creek 5 $\frac{7}{8}$ miles west of Canton. Duncan 9039 (Ga); 10 Oct., 1948; from the same station.

A duplicate of the October collection was sent to Dr. O. C. Rosendahl who kindly made the determination. In his letter in regard to the determination he states that the Cherokee County station extends the known range of the variety considerably to the southeast. Previously reported adjacent stations are in Etowah County, Alabama, adjacent Tennessee and western North Carolina.

3217. *HYDRANGEA RADIATA* Walt. RABUN: *Duncan* 9088 with *G. W. McDowell* and *Haskell Venard* (Ga); 2,700'; 19 Mar., 1949; at edge of steep rock outcrop in open woods overlooking ravine along Reed Creek south of Glade Mountain. *Duncan* 10142 (Ga); 2,900'; 24 Aug., 1949. Open slopes at edge of bottomland along Tally Mountain Creek. *Duncan* 10374 (Ga); 2,300'; along Reed Creek at junction of Glade and Burrell's Ford roads.

This species had been reported previously from the Blue Ridge and Piedmont of South Carolina and North Carolina (Small 1933), but apparently no specimens or records of its occurrence in Georgia were in existence. I have heard discussion concerning whether or not the species is clearly separable from *H. arborescens* L. It seems significant in this connection that both species were seen growing together at several localities in Rabun County and with no intermediates present in a large number of plants inspected.

3343. *AMELANCHIER OBOVALIS* (Michx.) Ashe. GWINNETT: *Duncan* 9108 with *S. J. Smith* (Ga); 3 Apr. 1949; 3.9 miles east of Lawrenceville.

This dwarf *Amelanchier* is said to occur along the Atlantic Coastal Plain as far south as Georgia (Jones, 1946), but its occurrence in the Piedmont of Georgia, where this station is located, is not indicated. This apparently is the first Piedmont record for the species.

3669. *CROTALARIA MUCRONATA* Desv. (*C. stricta* DC.). DECATUR: *Duncan* 6695 (Ga); 27 July, 1946; roadside bank northeast of Bainbridge. COLUMBIA: *Duncan* 10585 (Ga); 350'; 20 Oct., 1949; roadside at west end of Clark Hill Dam.

Small (1933) reports that this species is a native of the East Indies and occurs in "waste-places, pinelands and roadsides, Pen. Fla." It is obviously becoming established at localities much farther to the north. The present collections apparently are the first recorded for the state. The Columbia County collection was sent to Dr. F. J. Hermann for naming. His letter in reference to the collection states, "I believe it is being introduced at many points in the southeast of late, and it tends to escape and become established quite readily."

3820. *LESPEDEZA STIPULACEA* Maxim. CLARKE: *Cronquist* 4133 (Ga); weed in barren, pebbly red clay soil along roadside, Athens. COBB: *Duncan* 8651 (Ga); 855'; well drained soil at edge of cotton field 0.6 miles south of Acworth.

This introduced legume is becoming abundantly established in many places in the state. The citing of these collections establishes

a record of the species for the state of Georgia. Small (1933) doesn't even include the species in his "Manual."

3924. *GERANIUM COLUMBINUM* L. RABUN: *Duncan* 1500 (Ga); 4,600'; 9 July, 1939; rock crevices at top of Rabun Bald.

Small (1933) reports the species as native to Eurasia and as occurring in North America from North Carolina to South Dakota and New Jersey. The location from which the Rabun Bald collection was taken faintly suggests a possibility of this species being native to North America. Although some introduced species are present on the summit, this material from rock crevices at an unfrequented part of the mountain might not have been introduced.

3936. *OXALIS MARTIANA* (Zucc.) Small. THOMAS: *P. C. Beverly* (Ga); 23 Dec., 1948; moist soil along abandoned stagecoach road on north slopes of hill 12 miles north of Thomasville and 2 miles east of Ochlochnee.

Although reported by Small (1933) for the "Coastal Plain, Florida to Texas and South Carolina," I found no specimens in the herbaria visited to verify its occurrence in Georgia.

4273. *POLYGALA SENEGA* L. RABUN: *Duncan* 7753 (Ga); 9 Aug., 1947; 2,400'; wooded ravine west of Estatoah Falls. BARTOW: *Duncan* 8083 (Ga); 23 Apr., 1948; west side of Allatoona Creek $\frac{1}{4}$ mile south Etowah River. DADE: *McVaugh* 9052 (Ga); 5 June, 1948; west side of Lookout Mountain near base, 1 mile north of Sulphur Springs Station along Lookout Creek.

The range given by Small (1933) for this species includes Mississippi and North Carolina. It may be that this is intended to indicate that Georgia is within the range. Deam (1940) says that the species extends "southward to Georgia" and previous collections may have been reported from Georgia. The present records, therefore, may not be the first from the state but they do indicate that the range extends across the entire northern part of the state. The Cherokee County collection is the southeasternmost for the species.

4496. *EUPHORBIA HELIOSCOPIA* L. DEKALB-FULTON: *Duncan* 9113 (Ga); 4 Apr., 1949; near county line in Lenox Park area.

This plant is well established in an open area at edge of woods. The southern limit of its range is given by Small (1933) as North Carolina. This first record for Georgia is probably the southernmost for the species. This station was called to my attention by Haskell Venard and G. W. McDowell of Atlanta, Ga.

4532. *PACHYSANDRA PROCUMBENS* Michx. "Mountains of Georgia": *Chapman* (U). HARALSON: *P. M. Way* 42 (U); Apr. and May, 1900;

Tallapoosa. HARRIS: *Duncan* 9668 (Ga); north-facing, wooded slopes along Standing Boy Creek directly north of Columbus.

Mr. Max Goodley of "Foothold" north of Columbus kindly showed me the Harris County colony. The plants were abundant over a considerable area. This plant, whose relatives are mostly Asiatic, is rare. It seemed, therefore, that these records should be reported.

4594. *RHUS MICHAUXII* Sarg. "Georgia": *Torrey and Gray* (H) (Ex herb J. Torrey). "Georgia": *Boykin* (H,Y); 1845. ELBERT: *Duncan* 10551, (Ga); 1 Oct., 1949, open area on top of high ridge just north of Broad River and 14 miles southeast of Elberton.

This rare shrub is reported to occur in Georgia (Small, 1933), apparently on the basis of the collections of Torrey and Gray, and Boykin but no definite localities for the state seem to be available. The Elbert County station, therefore, establishes a definite station for the state.

5274. *VIOLA ERIOCARPA* Schwein. DADE: *Hermann* 10197 (H); 17 Mar., 1939; rock woods, Sitten's Gulch. FLOYD: *H. C. Jones* 105 (Ga); 9 Apr., 1939; low woods river bluff, Mount Berry. RABUN: *Duncan* 7500 (Ga); 4 May, 1947; 2,400'; steep, wooded, north slope of ravine near Estatoah Falls.

This yellow-petaled violet is reported by Small (1933) from "Ala. to Okla., Man., and N. S." which might be interpreted to mean that Georgia was either within or without the range of the species. These records leave no doubt about its occurrence in the state. Baird (1942) includes northern Georgia in the range for the species, but cites no stations.

6169A. *HYPOPHYTIS AMERICANA* (DC.) Small. RABUN: *Duncan* 9931 (Ga); 3,000'; 16 July, 1949; near bridge over Tally Mountain Creek. *Duncan* 7756 (Ga); 9 Aug., 1947; at Estatoah Falls.

This entity has also been treated as a variety of another species, but I haven't attempted to make a decision as to which treatment to follow. The above records are apparently the first for Georgia, Small (1933) giving the southern limits as "woods, Blue Ridge, N. C. and Tenn."

6172. *MONOTROPSIS ODORATA* Ell. HABERSHAM: *Perry and Straham* 978 (H); 31 May, 1934; under pine tree at top of Tallulah Falls. ELBERT: *Pyron and McVaugh* 3029 (Ga); 4 June, 1938; moist, rocky shores of Savannah River east of Elberton. HALL: *S. J. Smith* 4816, with *D. Charbanneau* (Ga); 2 Apr., 1949; 1,150' deep pocket of *Rhododendron* duff, north-facing bluffs along Chattahoochee River, 2 1/3 miles northeast of Bowdre. RABUN: *Duncan* 9309, with *S. J.*

Smith (Ga); 16 Apr., 1949; 2,600'; on slopes at Glade Falls southwest of Glade Mountain. GWINNETT: *Duncan* 10692, with G. W. McDowell (Ga); open woods on steep slopes on south side of Chattahoochee River 4.5 miles northwest of Buford.

Although Small (1933) included "N. Ga." in the range of this species, I located no specimens collected from Georgia before 1933. Previous collections were undoubtedly few, if any, and so those reported here add considerably to the knowledge of the distribution of the southern part of its range. The Gwinnett County collection is apparently the southernmost known for the species.

6188. *LEIOPHYLLUM LYONI* Sweet. RABUN: *Duncan* 10502 (Ga); 24 Sept., 1949; 3,000'; outer edge of woods and in open in shallow soil on rock above Cedar Cliff in northwest corner of county. *Duncan* 10833B (Ga); 6 May, 1950; from same station.

This interesting shrub was previously reported from the Blue Ridge, N. C., and Tenn. (Small, 1933 and Camp, 1938). It was to be expected in this part of Rabun County as it is known to occur a few miles away on Satulah Mountain, North Carolina. I doubt, however, that it occurs in Georgia outside of Rabun County.

7138. *VERBENA STRICTA* Vent. DOUGLAS: *Duncan* 8438 (Ga); 26 June, 1948; roadside at boggy area 1.5 miles east of Villa Rica.

This species previously had not been reported from Georgia, Small (1933) giving Tennessee as the southernmost state and Moldenke (1949) omitting Georgia from the range. The present collection is apparently the southernmost for the species as well as the first collection for Georgia. The species may have been introduced either by automotive equipment or by train as a railroad passes very close to the roadside.

7377. *NICANDRA PHYSALODES* (L.) PETS. GILMER: J. K. Small (Y); 13-16 Aug., 1895; about Ellijay. CHEROKEE: *Duncan* 8941 (Ga); 23 Sept., 1948; 6 miles east of Allatoona Dam. BARTOW: *Duncan* 8724 (Ga); 15 Aug., 1948; at Rowland Springs 4 miles north of Allatoona Dam.

It seems strange that Small (1933) does not include Georgia in the range when he had collected the species earlier from Gilmer County. Georgia should now be included in the range as my collections from Cherokee and Bartow Counties are from large colonies of plants around abandoned home and hotel sites.

7901. *UTRICULARIA SUBULATA* L. FORSYTH: *Duncan* 5243 (Ga); 17 May, 1942; base of Sawnee Mountain. DEKALB: Lily M. Perry and

McMyers 1036 (H); wet sandy ground at base of Pine Mountain, 1 mile north of Lithonia.

This species is generally considered to be confined to the Coastal Plain (Small, 1933) and there are many Georgia collections from this province. The collections reported here definitely establish the species as occurring in the Piedmont as well.

8482. *SHERARDIA ARVENSIS* L. CLARKE: *Pyron and McVaugh 1791* (Ga); 18 May, 1937; roadside, University of Georgia Campus. *Robert Norris* (Ga); May, 1948; waste places along Tanyard Branch in Athens.

This introduced plant is reported by Small (1933) from northern Florida and in Tennessee. I saw collections from several other states including Alabama but the above Clarke County collections are apparently the first for Georgia. The species seems to be well established at several places in Athens.

8816. *EUPATORIUM LEUCOLEPIS* T. and G. BARTOW: *Duncan 8888* (Ga); 18 Sept., 1948; 900'; open pasture on top of hill 2.1 miles southeast of Allatoona Dam. (Determined by L. H. Shinnars).

This species is reported as being confined to the Coastal Plain (Small, 1933). Its occurrence in the Piedmont as well is established by the above collection.

8849. *SOLIDAGO RADULA* Nutt. WHITE: *Duncan 4183A* (Ga); 9 Sept., 1941; 2500'; deciduous woods, gentle north slope on Yonah Mountain.

Small (1933) reports the species as occurring southward to North Carolina and Louisiana. The range as stated might be interpreted as including Georgia, but I have seen no specimens from the state other than the one reported here. This apparently is the first record for the state.

9146. *AMBROSIA MONOPHYLLA* (Walt.) Rydb. CHEROKEE: *Duncan 8986* (Ga); 25 Sept., 1948; 850'; broad bottomland on east side of Etowah River about 4½ miles southwest of Canton.

The Coastal plain has been reported as the area occupied by this species (Small, 1933). The present station, where the plant is abundant, is apparently the first record for the Piedmont.

9178A. *ECHINACEA ANGUSTIFOLIA* DC. [*E. pallida* (Nutt.) Britton; *Brauneria angustifolia* (DC.) Heller]. FLOYD: *Pennell 4087* (Y); 5 Aug., 1912; near locks on Coosa River below Rome. TREUTLEN: *O. M. Freeman*; Soperton. BARTOW: *Duncan 8248* (Ga); 5 June, 1948; open pine-deciduous woods, well drained soil ¾ mile southwest of Allatoona Dam. DOUGLAS: *Duncan 9672*; 5 June, 1948; railroad embankment 1.4 miles east of Douglasville.

Small (1933) gives Alabama as the nearest state for the range of this

species, omitting Georgia. The records from the above four counties establish well its occurrence in the state.

9237. *BIDENS CONNATA* Muhl. BARTOW: 8876 (Ga); 18 Sept., 1948; 760'; "springy place" in open, deciduous woods on hillside along Allatoona Creek 1¼ miles from Allatoona Dam. CHEROKEE: *Duncan* 9015 (Ga); 26 Sept., 1948; 845'; shallow, running water from small spring at edge of broad bottomland 6 miles southwest of Canton.

This species is reported by Small (1933) as occurring southward as far as "N.C. to Mo." and by Deam (1940) as "probably to Ga." Sherff (1937) includes Alabama and Tennessee in the range. These collections fit well into the pattern of distribution indicated by Sherff and definitely place Georgia in the range for the species.

9607. *HIERACIUM PRATENSE* Tausch. RABUN: *Duncan* 8234 (Ga); 16 May, 1948; 3,000'; roadside shoulders just above Estatoah Falls.

This introduced plant seems to be spreading rapidly. Earlier it must have been rare or absent from the Southeastern United States as Small (1933) does not include the species in his "Manual." Blomquist and Oosting (1948) indicate that it occurs in the Piedmont of North Carolina and I have seen several specimens from Tennessee and North Carolina mountains. Apparently, the nearest station to the Georgia record is at Linville Falls, N.C.

LITERATURE CITED

- Baird, V. B. 1942. *Wild Violets of North America*. 225pp. University of California Press. Berkeley and Los Angeles, California.
- Bishop, G. N. and W. H. Duncan. 1941. A New White Oak from Georgia: Its Associates and Habitat. *Journal of Forestry* 39: 730-731.
- Blomquist, H. L. and H. J. Oosting. 1948. *A Guide to the Spring and Early Summer Flora of the Piedmont, North Carolina*. 155pp. Published by the authors. Durham, N.C.
- Britton, N. L. and A. Brown. 1913. *Illustrated Flora of the Northern United States, Canada, and the British Possessions*. 3 volumes. Charles Scribner and Sons, New York, New York.
- Camp, W. H. 1938. Studies in the Ericales III. The genus *Leiophyllum*. *Bull. Torr. Bot. Club* 65: 99-104.
- Correll, D. S. 1940. A Contribution to Our Knowledge of the Orchids of the Southeastern United States. *Harvard University Botanical Museum Leaflets* 8: 69-92.
- Deam, C. C. 1940. *Flora of Indiana*. 1236pp. Department of Conservation, Indiana, Indianapolis, Indiana.
- Duncan, W. H. 1948. Preliminary Reports on the Flora of Georgia—1. The Distribution in Georgia of Spermatophytes new to or rare in the state. *Castanea* 13: 70-83.
- Duncan, W. H. 1950 a. A New Variety of *Arenaria*. *Phytologia* 3: 282.
- Duncan, W. H. 1950 b. Two New States for *Tridens strictus* (Nutt.). *Nash. Rhodora* 52: 126-127.
- Duncan, W. H. 1950 c. Preliminary Reports on the Flora of Georgia—2. The Distribution of 87 trees. *American Midland Naturalist*. 43: 742-761.

- Duncan, W. H. 1950 d. Preliminary Reports on the Flora of Georgia—3. The Distribution of seven Lycopsidea. *American Fern Journal*. 40: 169-173.
- Fernald, M. L. and Bernice Schubert. 1948. Studies of American types in British Herbaria IV. Some species of Thomas Walter. *Rhodora* 50: 190-208.
- Harrar, E. S. and J. G. Harrar. 1946. Guide to Southern Trees. 712 pp. McGraw-Hill Book Company, Inc. New York, New York.
- Hitchcock, A. S. 1935. Manual of Grasses of the United States. 1040 pp. U. S. Government Miscellaneous Publications, No. 200.
- Jones, G. N. 1946. American Species of Amelanchier. 126 pp. University of Illinois Press, Urbana, Illinois.
- Mackenzie, K. K. 1940. North American Cariceae. 2 Volumes, 539 plates with text. New York Botanical Garden. New York, New York.
- Moldenke, H. N. 1949. The Known Geographic Distribution of the Members of the Verbenaceae, Avicenniaceae, Stilbaceae, Symphoremaceae, and Eriocaulaceae. 214 pp. Published by the author. New York, New York.
- Sherff, E. E. 1937. The Genus *Bidens*. Field Museum Natural History Publications, Botanical Series 16: 1-709.
- Small, J. K. 1933. Manual of the Southeastern Flora. 1554 pp. Published by the author. New York, New York.
- Smith, A. C. 1947. The Families Illiciaceae and Schisandraceae. 224 pp. *Sargentia* 7: 1-224.
- Smith, L. B. 1935. Studies in Bromeliaceae VI. Contr. from the Gray Herbarium 106: 214-219.
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Tree-Ring Study in Kentucky, II*

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A survey was started in the early summer of 1949 to further my work in the study of growth rings in trees in Kentucky (No. I in 1947) and in particular to search for evidence for the probable cause of the Big Barrens of Kentucky. When this particular part of Kentucky was settled, the pioneers found an area composed of a narrow, more or less continuous strip around the Western Coal Basin and ranging in width from 10 to 30 miles that was covered with grasses and other prairie plants with a few small, scattered trees. These treeless areas were referred to as "Barrens", because the settlers considered the land non-productive. These men had always associated certain species of trees with definite land quality and here they found a region that was devoid of trees, therefore, it was considered poor in quality or barren. Since most of the grassland was in this one large tract, the name "Big Barrens" was given to the region.

Much speculation has been made as to the cause or causes of this prairie vegetation in a narrow strip more than 200 miles long with a good forest growth on each side. Michaux (1805) explained that the whites were following the custom of the Indians by burning the grass in early spring to attract game into the open and to make better pasturage for the cattle. And Shaler (1885) thought that this custom of the Indians was the main cause of this grassland by destroying the trees that were once present and allowing the grass to grow. On the other hand, Sauer (1927) seemed to think that the nature of the underlying rock had something to do with the development of the grassland and he noted that there was a fairly close correlation between the area of the prairie vegetation and the Cavernous limestone. But Transeau (1935) brought out the fact that certain factors of climate, especially humidity in mid-summer, were a contributing cause. He showed that humidity was a little lower here and in the Western Coal Basin than in other parts of the state. With no change in altitude at the lines of contact between this geologic region and those on either side, a person would think that a change in humidity would be very slight or gradual. Nevertheless, the change in the vegetation at these lines of contact was very abrupt in most cases.

There is a noticeable difference in the texture of the soils in the three regions that are under consideration and this fact might prove

*This project, as well as some others, was financed by money provided by the Research Fund Committee of the University of Kentucky.

to be a deciding factor in the type of vegetation that will survive under abnormal conditions. Shantz (1938) brings out the fact that sand is an "equalizer" in that coarse soil is drier in a region of heavy rainfall and damper than fine soils in a region of light rainfall. Consequently, xerophytes will extend further into a region of heavy rainfall on sandy soils than on clay or silt. This soil of the Cavernous Limestone region has much clay and only a little sand while that on either side is much coarser—even sandy. Furthermore, roots can penetrate this coarse soil to a comparatively great depth, since it is open and well aerated. And besides, in the region of fine soil, much more water is lost as run-off, because the rate of infiltration is less there than in the coarser soils. Not only that, but permanent wilting occurs on fine soil when there is yet a great amount of water present while this is not the case on coarse soils since the plants can absorb most of the water present under the latter conditions. In other words, most of the water of coarse soil is readily available to the plants while this is not the case in fine soils, for those soils composed of very small particles retain large amounts of water based upon the oven dry weight of the soil. As an example, at the time of permanent wilting of plants, the water in sand may not be more than 1% while in clay it may be as much as 10% at the time in which plants reach this critical point.

In my article on the Barrens of Kentucky (1942), I maintained that this land type was, in a measure, responsible for the presence of the Barrens or at least the initiation of the prairie vegetation. No doubt frequent fires played a great part in maintaining this prairie vegetation, however. Fires which would kill seeds and the trees which bore them would scarcely hurt the underground parts of herbaceous perennials, from which shoots could readily grow. This being the case, fires were to the advantage of the prairie plants. Much credit should be given to those who stress the importance of fires in this case, for fires were much more effective here than they would have been in the other parts of the state. Since there were practically no valleys or surface streams in the Barrens, fires had no natural barriers such as we find in the other section of Kentucky.

The region of the Big Barrens closely coincides with a strip of land derived from soluble limestones, composed of Renault-Paint Creek, Ste. Genevieve, and the upper part of the St. Louis, and therefore, it seems reasonable to claim that the quality of the rock was a great contributing factor in the invasion of the prairie vegetation in a region that was surrounded by forests. This region of which the

underlying rock is a very soluble form of limestone has no surface streams of water, for they are all underground. True valleys are rare but sink holes are common. Rain water seeps down through the soil or runs into these sink holes and drains away by means of this natural subterranean drainage system. There is no standing water, for it is all in the process of running away. Then, there is no definite ground water, for all of the gravitational water goes into these streams, therefore, water, by means of capillarity, could scarcely, if at all, move upward through this layer of limestone which is practically impermeable to water.

The whole explanation of the cause of the Barrens is complex. It seems that certain factors of climate (especially low rainfall and low humidity) played a great part in bringing about the peculiar vegetation on land which had a tendency to be thirsty, by being unfavorable to forest vegetation. Invasion of prairie plants soon followed the destruction of the trees and then frequent fires were favorable to the grasses.

This survey on Tree-Ring study is to see if the growth of trees in the three geological regions—Chester, Cavernous Limestone, and Borden or Waverly Shale—are affected similarly by the extremes in periodic rainfall. There was a part of the Cypress sandstone of the Chester series included in this grassland, but it was always where the soluble limestone was only a few feet below the surface. In this study I find that the trees of the Cavernous Limestone are affected a little more by the variations in rainfall than are those of the other two regions. This difference is slight, yet it is rather constant and it may be that it is sufficient to account for the unusual vegetation that was found near the middle of the Deciduous Forest formation. Obviously, that water which runs away on the surface and that which percolates through the soil and is lost by this underground drainage system, cannot be used by the plants. Therefore, this region has a tendency to be thirsty. A severe drought of a few centuries ago might have brought about the death of the trees of this region while those on either side could have endured the period of low rainfall. I am aware of the fact that a statement of the total rainfall by the day, month, or any other period lacks a whole lot indicating the amount of water that might be absorbed and retained by the soil in the three regions. Therefore, many years must be taken into consideration to even suggest a basis for an accurate statement on this matter.

The rainfall records were taken from reports of the U. S. Weather Bureau at Louisville of which Bowling Green is a substation. Since

all three of these stations from which samples were taken are within a comparatively short distance of Bowling Green, it is felt that there would be a very little difference in the periodic rainfall at the three places.

The species of tree selected for this study is *Liriodendron Tulipifera* L. (Tulip tree or yellow poplar), partly because it is common in each of the three regions and partly because the rings are fairly easily read. From these trees samples were taken, waist high, by means of an increment borer. The samples were dried and cemented on boards by the use of plastic wood filler. Then, by the use of fine sand paper, the rings were made quite distinct.

Eight trees were sampled in each of the three stations and two cores were taken from each in such a way as to represent two radii. However, a few of the samples were discarded, for no degree of certainty could be felt regarding some of the rings. Ring widths were determined in units of 0.1 mm. and the average for each year was calculated for each tree and for each station and these averages, as units, were matched against the periodic rainfall for the corresponding times.

The soil of the Chester region is very acid and is low in the essential minerals. As a whole it is considered poor in quality in comparison to the soil of the other two regions. And yet the rings are wider in the samples taken here than in the other stations. This difference is partly due to the fact that these trees are young while those of the other two regions are older, especially those of the Cavernous Limestone station. The average width of the rings is 4.4 mm. The underlying rocks are composed of sand, for the most part. The station selected for this study is on State Highway 263, 10 to 12 miles north of Bowling Green and near Riverside. The trees are widely scattered.

The station selected in the Cavernous Limestone region is in the territory of the original Big Barrens. It is a grove on the farm of H. R. Hardcastle in the southern half of Warren County, which is about six miles south east of Bowling Green. The samples were taken from rather large trees that were scattered over several acres and on slopes facing different directions. The relief of the land is fairly even—enough so that it could easily be cultivated with the light farm equipment that is used for corn, tobacco, and hay. The average width of the rings is 3.2 mm.

The woods chosen to represent the Borden region is on the farm of Elvis Cole in Allen County and to him, as well as Mr. Hardcastle

of the Cavernous Limestone region, I wish to acknowledge thanks for the privilege of taking the necessary samples. This woodland is on the east side of State Highway 71 and is just south of the village "Halfway." It is 16 miles southeast of Bowling Green. The relief of the land of this station is about like that which represents the Cavernous Limestone region. Apparently, the land is rather productive, judged by the type of vegetation and the general appearance of the plants present. The underlying rocks are composed of shale and fine sandstone.

Table 1. The amount of some of the minerals, expressed as pounds per acre in the first seven inches of soil and also the acidity, calculated as lime (CaO). Averitt (1915).

Area	Total Nitrogen	Total Phosphorus	Total Potassium	Acidity
Chester	1700	702	26560	500
Cavernous Limestone	2106	890	28220	140
Borden	1960	650	19600	280

It is desirable here to give a short explanation of why the period extending from the first of August to the last of the following July was considered as constituting a year rather than some other period. The month of August, as well as the rest of the calendar year, was felt to belong to the following growing season instead of the current one in each case. It seems that the growth of each year was about complete by the first of August or, at least, the rain in August had little influence, if any, on the growth at that time. When considering all three stations, it was found that the positive correlation between rainfall of August and growth the following year was 64%. On the other hand, the correlation between rainfall of August and growth in the same year was 49%. Or, in other words, it could be said that there was no correlation, for 50% would represent that fact. And while there was no correlation between the rainfall of August and growth of the current year, this was not true with regard to July, for the per cent of positive correlation in this case was 63% for the Chester, 70% for the Cavernous Limestone, and 60% for the Borden (an average of 64%). I am not giving tables to illustrate these facts, for in so doing two long tables would be constructed merely to give evidence that these statements are accurate. It is felt that so much additional space is not necessary to substantiate these sentences. These references to the degree of correlation are of such a nature that they are considered "positive" in those cases in which a heavy rainfall is followed by a

marked increase in growth and a light rainfall by a pronounced decrease in ring growth.

An examination of the various tables throws some light upon the idea that the trees of the Cavernous Limestone region (trees of the Big Barrens) are a little more sensitive to the extremes in rainfall than are those of the other two regions. The per cent of positive correlation, as expressed in Table I, is 62, 82, and 81 respectively for the Chester, Cavernous Limestone, and Borden regions. This is for a twelve-month period of rainfall and yet the per cent of correlation is fairly high except for the Chester. When examining Table II, which correlates the rainfall of August to February with growth in the following summers, the figures are not so high, for the positive correlation for the three stations is 55, 64 and 74 respectively. Apparently, in this period, water can be retained much better by the Borden soil than can be done by the other soils.

When considering Table III, which shows the rainfall for the remainder of the year—March to July—a much closer correlation is noted with the largest number being associated with the Cavernous Limestone station. These figures are 73, 92, and 79, respectively. Evidently, the trees of the Cavernous Limestone region respond much more to spring and summer rains than do those of the Chester and Borden regions. And Table IV which considers May, June, and July gives figures that are quite similar to Table III except for the fact that the Borden has a number which shows a larger per cent of positive correlation. The results, as shown in Table IV, are 70, 93, and 87 for the Chester, Cavernous Limestone, and Borden, respectively.

Table V shows the amount of growth at each of the three stations for the ten wettest March-July periods and for the ten driest periods of March-July. This table reveals that the trees of the Cavernous Limestone region respond a little more to these extremes in rainfall than did those of the other two regions. These differences between the average growth of the ten wettest and ten driest years are 1.08, 1.23, and 1.21. These numbers for the three stations are quite similar, but if the comparison is made in terms of percentage, the results appear different. In the Chester region the trees grow 78% as much in the driest years as in the wettest. This growth was 67% in the Cavernous Limestone and 72% in the Borden indicating, again, that the trees of the Cavernous Limestone region cannot thrive as well in the seasons of low rainfall as in the other two regions.

It must be that there are many factors, other than periodic rainfall, that influence the amount of growth, and yet there are no out-

standing years in which this correlation is represented as negative when we consider all of the tables. The years 1939 and 1916 might be considered in this class of negative correlation when we consider all of the periods and especially is this true for the Cavernous Limestone and Borden regions. On the other hand there are a few years of which almost all of the marks show positive correlation. They are 1935, 1918, and 1936. 1935 was a wet year with wide rings while the other two were dry years with narrow rings. Table VII shows that the correlation is close when we consider the very widest and very narrowest rings in each station, for associated with the wide rings the rainfall was decidedly above normal and with the narrow rings it was far below normal.

Table II. Correlation between growth in the three stations and rainfall for certain years beginning the first of August of the previous year and ending the last of July of the current year.

(+ sign indicates positive correlation; — indicates negative).

A. A comparison in which both rainfall and width of growth rings varied as much as 10% from those of each of the preceding years. It obviously follows that many spaces are left blank.

B. A comparison in which rainfall varied as much as 10% from normal and growth 10% from average.

Year	Chester	Cavern- ous lime	Borden	Year	Chester	Cavern- ous lime	Borden
1946 dry	—	+	+	1944 dry	+		+
1945 wet	+	+	+	1941 dry	—	+	+
1944 dry	+		+	1940 dry	+	+	+
1943 dry	—		+	1939 wet	+	—	—
1942 wet		+	—	1937 wet	—	—	—
1940 dry	+		+	1936 dry	+	+	+
1939 wet	—	—	—	1935 wet	+		+
1938 dry	—	—	—	1934 dry	—	+	+
1937 wet	+	+	+	1933 wet	+		—
1936 dry	+	+	+	1932 wet	+	—	
1935 wet		+	+	1931 dry	—	+	
1934 dry		+	+	1930 dry	+	+	+
1932 wet	+	+		1927 wet		+	+
1930 dry	+	+	—	1926 dry		+	
1928 dry	—	—		1924 wet		+	+
1927 wet		+	+	1923 wet	+	+	+
1926 dry		+		1922 wet		+	+
1925 dry	+	+	+	1921 dry		+	+
1923 dry	—	+	—	1920 wet	—	+	+
1922 wet		+	+	1918 dry	+	+	+
1921 dry	—	+	+	1917 wet			+
1920 wet	+	+	+	1916 wet	+		+
1919 wet		+	+	1914 dry	+	+	+
1918 dry	+	+	+	1912 wet	—	+	+
1916 wet	+	—	—		12.6	16.3	18.3
1915 wet	—	+	+		67%	84%	85%
1914 dry	—	—					
1913 dry	+	+	+				
1912 wet		+	+				
1911 dry		+	+				
	12.9	20.5	20.6				
	57%	80%	77%	Av. A & B	62%	82%	81%

Table III. Correlation between growth at the three stations and rainfall for August to February.

A. A comparison in which both rainfall and width of growth rings varied as much as 10% from this period of each of the preceding years.

Rain Year	Ches- ter	Cavern- ous Lime	Borden
dry 1947	—	—	—
dry 1946	—	—	+
wet 1945	+	+	+
dry 1944	+	—	+
wet 1942	—	+	—
dry 1940	+	—	+
wet 1939	+	—	—
dry 1938	—	—	—
wet 1937	+	+	+
dry 1936	+	+	+
wet 1935	—	+	+
dry 1934	—	+	+
dry 1933	—	—	+
wet 1932	+	+	—
dry 1931	—	+	—
wet 1930	—	—	—
dry 1928	—	—	—
wet 1927	—	+	+
dry 1925	+	+	+
wet 1922	—	+	+
dry 1921	—	+	+
wet 1920	+	+	+
wet 1919	—	+	+
dry 1918	+	+	+
dry 1917	—	—	—
wet 1916	+	—	—
wet 1915	—	+	+
dry 1914	—	—	—
wet 1912	—	—	+
	11.9	15.7	18.7
	55%	68%	72%

B. A comparison in which rainfall varied as much as 10% from normal and growth 10% from average.

Rain Year	Ches- ter	Cavern- ous Lime	Borden
dry 1947	—	—	—
wet 1945	—	+	—
dry 1944	+	—	+
dry 1941	—	+	+
dry 1940	+	+	+
wet 1939	+	—	—
dry 1938	—	—	—
wet 1937	—	—	—
dry 1936	+	+	+
wet 1935	+	—	+
wet 1932	+	—	—
dry 1931	—	+	—
dry 1929	—	—	—
wet 1927	—	+	+
wet 1924	+	+	+
wet 1923	+	+	+
wet 1922	—	+	+
dry 1921	—	+	+
wet 1920	—	+	+
dry 1919	+	—	—
dry 1918	+	+	+
wet 1917	—	—	+
wet 1916	+	—	+
wet 1915	—	+	+
dry 1914	+	+	+
wet 1913	—	—	—
dry 1910	—	—	—
dry 1909	—	—	+
	12.10	14.8	17.6
	55%	64%	74%
Av. A & B	55%	66%	73%

Table IV. Correlation between growth at the three stations and rainfall during the period of March to July.

A. A comparison in which both rainfall and growth rings varied as much as 10% from this period of each of the preceding years.

Rain Year	Ches- ter	Cavern- ous Lime	Borden
wet 1947	+		+
wet 1945	+	+	+
dry 1944	+		+
wet 1943	—		+
dry 1939	+	+	+
wet 1938	+	+	+
dry 1936	+	+	+
wet 1935	+	+	+
dry 1934	+	+	+
wet 1933			—
wet 1932	+	+	
wet 1931	+	—	+
dry 1930	+	+	+
wet 1927		+	+
dry 1926		+	
dry 1923	—	+	—
wet 1922		+	+
dry 1921		+	+
wet 1919		+	+
dry 1918	+	+	+
dry 1917		+	
dry 1915	+	—	—
wet 1914	+	+	
dry 1913	+	+	+
wet 1912			+
dry 1911			+
	15.2	18.2	19.3
	88%	90%	86%

B. A comparison in which rainfall varied as much as 10% from normal and growth 10% from the average.

Rain Year	Ches- ter	Cavern- ous Lime	Borden
wet 1948	—	+	—
dry 1946	—		+
dry 1944	+		+
wet 1938	+		+
dry 1937	+	+	+
dry 1936	+	+	+
wet 1935	+		+
dry 1934	—	+	+
wet 1933	+		—
dry 1931	—	+	
dry 1930	+	+	+
wet 1928	+	+	+
wet 1927		+	+
dry 1926		+	+
wet 1922		+	+
wet 1920	—	+	+
wet 1919	—	+	—
dry 1918	+	+	+
dry 1916	—		—
dry 1915	+	—	—
dry 1913	+	+	
wet 1912	—	+	+
wet 1910		+	+
wet 1909		+	—
	11.8	17.1	16.6
	58%	94%	73%
Av. A & B	73%	92%	79%

Table V. Correlation between growth at the three stations and the total rainfall of May, June, and July.

A. A comparison in which both rainfall and growth rings varied as much as 10% from this period of each of the preceding years.

Rain Year	Ches- ter	Cavern- ous Lime	Borden
wet 1947	+		+
wet 1946	+	+	+
dry 1944	+		+
dry 1942		—	+
wet 1941	+		+
dry 1939	+	+	+
wet 1938	+	+	+
wet 1937	+	+	+
dry 1936	+	+	+
wet 1935		+	+
dry 1934		+	+
wet 1933			—
wet 1932	+	+	
dry 1930	+	+	+
wet 1928	+	+	
wet 1927		+	+
dry 1926		+	
dry 1925	+	+	+
wet 1924	—		—
dry 1923	—	+	—
wet 1922		+	+
dry 1921	—	+	+
wet 1920	+		+
wet 1919		+	+
dry 1918	+	+	+
dry 1917		—	
dry 1916	—	+	+
wet 1915	—	+	+
wet 1914	+	+	
dry 1913	+	+	+
	16.5	22.2	22.3
	76%	92%	88%

B. A comparison in which rainfall varied as much as 10% from normal and growth 10% from average.

Rain Year	Ches- ter	Cavern- ous Lime	Borden
wet 1948	—	+	
dry 1946	—		+
dry 1944	+		+
dry 1943	+		+
dry 1942	+		+
dry 1940	+	+	+
dry 1939	—	+	+
wet 1938	+		+
dry 1937	+	+	+
dry 1936	+	+	+
wet 1935	+		+
dry 1934	—	+	+
wet 1933	+		—
dry 1932	—	+	
dry 1931	—	+	
dry 1930	+	+	+
wet 1928	+	+	+
dry 1926		+	
dry 1923	—	—	—
wet 1922		+	+
dry 1921		+	+
wet 1920	—	+	+
dry 1918	+	+	+
dry 1917			—
wet 1915	+	+	+
dry 1914	+	+	+
dry 1913	+	+	
wet 1910		+	+
	14.8	19.1	20.3
	64%	95%	87%
Av. A & B	70%	93%	87%

Table VI. The amount of rainfall in the March-July period of the ten wettest and ten driest seasons with the amount of growth at each of the stations for the respective years. The difference between the average of the wet and that of the dry years, when expressed in percent, is based upon the average ring width at each station for all of the years.

Wet Years					
Year	Rainfall	Chester	Cavernous Limestone	Borden	Average
1935	38.58	6.6	3.3	4.4	4.8
1922	34.51	4.2	5.5	4.9	4.8
1927	28.66	4.2	3.5	5.6	4.4
1920	28.02	3.1	3.7	4.2	3.7
1919	28.02	3.1	3.7	3.6	3.5
1933	27.94	6.1	3.1	3.2	4.1
1928	27.24	5.6	4.4	5.5	5.2
1938	26.72	7.2	3.4	4.3	5.0
1948	25.41	3.3	3.5	1.9	2.9
1923	23.98	6.4	3.5	5.7	5.2
Average	28.91	4.98	3.76	4.33	4.36
Dry years					
1930	10.12	4.0	2.5	3.0	3.2
1918	12.45	3.5	2.6	2.6	2.9
1926	14.64	4.5	2.2	3.4	3.4
1934	14.71	6.5	2.5	2.6	3.9
1931	15.06	5.2	2.1	3.5	3.6
1944	15.91	2.0	3.1	1.9	2.3
1936	16.20	1.8	1.3	1.2	1.4
1937	16.87	4.0	2.5	2.8	3.1
1916	18.38	4.9	3.0	4.9	4.3
1915	18.40	2.6	3.5	5.3	3.8
Average	15.67	3.9	2.53	3.12	3.19
Difference	13.24	1.08	1.23	1.21	1.17

Table VII. The two widest and two narrowest rings for each of the three stations with the years and rainfall of March-July.

Station	Width	Year	Rainfall	Average Ring Width	Average Rainfall
Chester	7.2 mm.	1938	26.72		
	6.6 mm.	1935	38.58		
	1.6 mm.	1936	16.20	6.9	32.65
	2.0 mm.	1944	15.91	1.8	16.05
St. Louis	5.5 mm.	1922	34.51		
	4.4 mm.	1928	27.24	5.0	30.87
	1.3 mm.	1936	16.20		
	2.1 mm.	1931	15.06	1.7	15.63
Borden	5.7 mm.	1923	23.98		
	5.6 mm.	1927	28.66	5.7	26.32
	1.2 mm.	1936	16.20		
	1.9 mm.	1944	15.91	1.6	16.05

LITERATURE CITED

- Averitt, S. D. 1915. Soils of Kentucky, Ky. Agr. Exp. Sta. Bull. 193.
 McInteer, B. B. 1942. The Barrens of Kentucky, Trans. Ky. Acad. Sci. 10: 7-12.
 1947. Tree Ring Study in Kentucky, Castanea, Jour. So. App. Bot. Club. 12: 38-50.
 Michaux, F. A. 1805. Travels to the Westward of the Alleghany Mountains in the States of Ohio, Kentucky, and Tennessee. . . Undertaken in the year 1802. . . Transl. from original French by B. Lambert, London. Printed for Richard Phillips.
 Sauer, Carl Ortwin. 1927. (Assisted by John B. Leighly, Kenneth McMurray, and Clarence W. Newman) Geography of the Pennyroyal. . . Ky. Geol. Sur. 25: 303 pp., illus.
 Shaler, N. S. 1885. Kentucky: a Pioneer Commonwealth. Houghton, Mifflin and Company. New York.
 Shantz, H. L. 1938. Plants as Soil Indicators. Yearbook of Agriculture. U.S. Dept. of Agr. 835-860.
 Transeau, E. N. 1935. Prairie Peninsula. Ecology 16: 423-437.

UNIVERSITY OF KENTUCKY
 LEXINGTON

NOTES and NEWS

THE WEST VIRGINIA FIELD TRIP.—The Fourth Annual Field Excursion of the Northeastern Section of the Botanical Society of America was held in West Virginia on September 3 to 9, 1950. A few members of the Ecological Society of America from other sections also participated. A total of 57 persons, representing 6 states, the District of Columbia, and one Canadian Province, took part in the trip. The excursion began at West Virginia University, in Morgantown and ended at White Sulphur Springs.

Dr. Earl L. Core, president of the Northeastern Section, organized the expedition and led the motorcade. A distance of 675 miles was travelled through botanical highspots in eastern West Virginia, southern Pennsylvania and western Maryland. Assistance in leadership was given in various part of the trip by the following: Prof. E. H. Tryon, Dr. R. Markus, Dr. P. R. Stewart, Prof. G. G. Pohlman, Dr. H. A. Wilson, Prof. O. M. Neal, Mr. C. R. Carr, Mr. W. M. Stiteler and Miss Gladys Tuke.

Major stops were made during the trip to permit the examination of areas of taxonomical and ecological interest. Development of vegetation and soils was observed on 100-year old iron-ore spoil banks in Cooper's Rock State Forest, and Glade Run Swamp in Penn-

sylvania was visited on Monday. Forage plots and tree plantings on 6-year old graded spoil from strip coal mines and a lily breeding project were inspected near Reedsville during the second morning. A pleasant Tuesday afternoon was spent collecting in and around Pine Swamp, north of Kingwood. Dolly Sods on Allegheny Mountain and the shale barrens nearby received the attention of the party on Wednesday. The highspots of Thursday included an examination of the vegetation on the top of Spruce Mountain, the highest point in West Virginia (elevation 4860 feet), and a visit to a virgin spruce forest on Cheat Mountain. Much of Friday was occupied in and near Cranberry Glades Natural Area. Saturday morning found the party in the vicinity of White Sulphur Springs, which is of botanical interest because of the numerous visits once made there by members of the New York Botanical Garden.

Members of the party were fortunate in being guided through Cooper's Rock State Forest and Monongahela National Forest during the course of the excursion.

Many plant species were encountered which are of interest because of their rarity or distribution. Numerous endemics of the shale barrens were observed. Among these were *Astragalus distortus*, *Opuntia humifusa*, *Viola pedata*, *Eriogonum allenii*, *Clematis albicoma*, *Trifolium virginicum*, *Oenothera argillicola*, *Pseudotaenidia montana* and *Senecio antennariifolius*, the type localities of the last six being visited. The southernmost extensions of *Larix laricina*, *Abies balsamea*, *Pinus resinosa* and *Andromeda glaucophylla* were also observed.

Instruction in the botany of the region was given during several evenings. This included talks by Dr. J. E. Harned on "Wild Flowers of the Alleghenies" and by Dr. G. A. Loughridge on the "Cranberry Glades," as well as a lecture by Dr. E. T. Wherry on the shale barrens. An excellent colored movie on "Wild Flowers of the Alleghenies" was shown by its producer, Mr. H. P. Sturm. Rev. R. W. Morrow and Mr. Sturm exhibited some superb kodachromes.

Members of the party who were not previously familiar with the vegetation of the region saw an excellent cross section of the botany of the Alleghenies. The habitats visited were diverse and provided an opportunity for the examination of a wide range of plant species under natural conditions. The informal discussion which occurred throughout the week was valuable in transmitting botanical knowledge. Members of the excursion appreciated the opportunity to have contact with such noted botanists of this area as Dr. E. L. Core, Dr. R. Griggs, and Dr. E. T. Wherry.

The organization of the excursion was of a high caliber with the result that everything went according to schedule. The trip was characterized by having local leadership best qualified for each particular visit and by a program sufficiently full to keep everyone busy but not such as to exhaust the party for the informative evenings.

Great credit is due to Dr. Core and his staff at West Virginia University for their success in arrangements for this trip. The weather cooperated throughout the week and automobile mishaps were not encountered.

Those taking part in the trip were:

Nelle Ammons, Morgantown; Lena Artz, Waterlick, Va.; Mr. and Mrs. Charles Baer, Morgantown; Elizabeth Ann Bartholomew, Morgantown; Mr. and Mrs. H. L. Barnett, Morgantown; Herald D. Bennett, Morgantown; Russell G. Brown, College Park, Md.; C. R. Carr, Petersburg, W. Va.; Ching-Cheng Chen, Morgantown; Anna A. Conn, Uniontown, Pa.; David Core, Morgantown; Earl Core, Morgantown; Robert T. Coupland, Saskatoon, Sask.; Mr. and Mrs. H. A. Davis, Morgantown; Wayne Davis, Morgantown; Thelma Ellis, Dayton, Ohio; Jane Friant, Morgantown; James A. Fowler, Philadelphia, Pa.; Mr. and Mrs. Robert Griggs, Pittsburgh, Pa.; James E. Harned, Oakland, Md.; Mr. and Mrs. J. I. Hommel, Pittsburgh, Pa.; Eugene Hutton, Elkins, W.Va.; Isabel T. Isanogle, Westminster, Md.; Clyde H. Jones, Columbus, Ohio; David Kolb, Baltimore, Md.; A. W. Kuchler, Lawrence, Kan.; William T. Leeson, Morgantown; Gasper Loughridge, Elkins, W.Va.; John C. Ludlum, Morgantown; E. Meade McNeill, Athens, W.Va.; Rudolfs Markus, Morgantown; A. B. Massey, Blacksburg, Va.; R. W. Morrow, Davis, W.Va.; Conrad Morton, Washington, D.C.; O. M. Neal, Morgantown; Anna Belle Owens, College Park, Md.; G. G. Pohlman, Morgantown; Jane W. Roller, Washington, D.C.; James B. Ross, Pittsburgh, Pa.; Mrs. Clara Sheldon, Morgantown; Paul R. Stewart, Waynesburg, Pa.; W. M. Stiteler, Durbin, W.Va.; H. P. Sturm, Clarksburg, W.Va.; Robert Sutcliffe, Philadelphia, Pa.; Harry W. Trudell, Abington, Pa.; Rodney P. True, Morgantown; Mr. and Mrs. Earl H. Tryon, Morgantown; Gladys Tuke, White Sulphur Springs; Edgar T. Wherry, Philadelphia, Pa.; H. A. Wilson, Morgantown; Ellen Z. Vandervort, Morgantown.

—R. T. COUPLAND, UNIVERSITY OF SASKATCHEWAN, SASKATOON.

A LIST OF WEST VIRGINIA PLANTS.—A new "Checklist of the Vascular Plants of West Virginia", by Earl L. Core, was issued recently as a publication of the Department of Biology. This book, in handy pocket-book format, contains a list of all the ferns, fern allies, conifers,

and flowering plants found in West Virginia, with brief notes concerning their distribution within the State. A total of 1999 species is included in the list, which is a compilation of names of plants recorded in all known publications dealing with the botany of the State from the earliest times down to the present. The nomenclature and arrangement follows that of the Eighth Edition of Gray's Manual, published in June, 1950, which will be the standard work on northeastern plants for many years to come. The checklist is preliminary to the publication of the large illustrated "Flora of West Virginia", now nearing completion by Dr. Core and P. D. Strausbaugh. Single copies may be obtained free of charge by application to the Department of Biology, West Virginia University.

SHRUBS OF WEST VIRGINIA.—Latest in the series of publications originating in the Department of Biology is "Shrubs of West Virginia", by Nelle Ammons, Associate Professor of Botany. This is a semi-popular description of the shrubby plants growing wild in the State, and 198 species are treated. A short description of each species is given, together with pen-and-ink sketches. The book is designed to be of value not only to the botany student and the nature lover but also to biology teachers, nature study leaders, foresters, farmers, gardeners, garden club enthusiasts, conservationists, vacationers, landscape designers, park specialists and others. Single copies may be obtained free of charge by writing to the Department of Biology, West Virginia University, Morgantown, W.Va.

Dr. Ammons, a native of Pennsylvania and a graduate of the University of Pittsburgh, has been a member of the staff here since 1917 and has been collecting material for the publication for many years.

NEW BIOLOGY BUILDING AT WEST VIRGINIA UNIVERSITY.—The new \$2,000,000 Biology Building at West Virginia University was used for the first time at the beginning of the fall semester, although work of installing furniture in some of the laboratories was not yet completed. The building includes specialized class rooms for laboratory work in plant and animal physiology, biological technique, comparative anatomy, embryology, genetics, bacteriology, and plant pathology, in addition to laboratories for general biology, botany and zoology. An animal museum is located on the first floor and the herbarium on the fourth floor. The herbarium will have storage space for more than a quarter of a million specimens and replaces the old facilities in Science Hall, long a fire-hazard. Numerous small libraries, as well as research laboratories are provided.

BOOK REVIEW

A FRESH APPROACH TO PLANT PATHOLOGY.—The science of plant pathology is relatively young and most text books so far published in this field have been largely descriptive with a more or less orderly aggregate of factual data, relating to a selected list of diseases. A comprehensive treatise on the principles of plant pathology has not yet been prepared. Gäumann's "Principles of Plant Infection"* is the first serious attempt in this direction and the English speaking members of the profession owe a debt of gratitude to Prof. Brierly and his associates for the excellent English edition. Although the subject has been treated in a thorough manner by the author, its scope is limited to the principles underlying infection of plants by fungi, bacteria and viruses. The large field of physiological or non-parasitic diseases was intentionally excluded. Also it seems to the reviewer that the important subject of pathological anatomy was given inadequate treatment even though reference is made to the earlier works of Küster. Only two pages are devoted to pathological tissue changes.

The most noteworthy feature of the book is found in Chapter 4 in which 193 pages are devoted to what is called "The Disease Proneness of the Host". Many of the ideas and terms presented in this chapter are new and unique and will not be readily accepted by all botanists and plant pathologists. In the opinion of the reviewer, the use of the term "proneness" to include both the "inherited, genotypic" characters of the host and the factors of the environment as they influence disease tends to confuse rather than clarify the problem.

Also many botanists will deplore the author's implication of will and purpose in the so called defense reactions of resistant hosts. "The 'lack of inclination' of an organism to serve as host is judged on the basis of its defence reactions; it is an expression of its 'will to defence' ". The term axeny is introduced to designate the "lack of fitness of an organism to act as a host, i.e. unhospitableness". "Hence strictly speaking an axenic resistant plant is not 'resistant' but merely not susceptible".

The author makes frequent comparisons and contrasts with phenomena of infection and resistance in animals. He recognizes the fundamental differences between plants and animals with respect to their mechanisms of resistance and immunity, but there is a tendency to interpret the reactions of plants to infection as being fun-

*Principles of Plant Infection. Ernest Gäumann, authorized English Edition edited by William B. Brierly, Hafner Publishing Co. New York 1950. 543 pp. \$8.00.

damentally the same as those in animals. This viewpoint is indicated by the frequent use of such terms as "phagocytic reactions", "acquired agglutinins", "antigenic activity", "antitoxic reaction", to designate reactions occurring in plants. Although plant pathology has learned much from the science of human medicine its progress has often been hindered by attempts to borrow *in toto* concepts from animal pathology and apply them to analogous phenomena in plant pathology.

The book is very readable. The editor and his associates apparently have faithfully translated the ideas and meaning of the original text into smooth understandable English. It is a valuable contribution and, in the words of the editor, "Botanists and Plant Pathologists will find this book not only a mine of information but they will also find it a mine of argument and controversy and a source of endless discussion and questioning, which is what a book of this kind should be."—J. G. LEACH, West Virginia University.



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